

PUBLIC HEALTH ASSESSMENT

NEWTON COUNTY WELLS (a/k/a SILVER CREEK TCE)
JOPLIN, JASPER COUNTY, MISSOURI
[EPA FACILITY ID: MOD985798339](#)

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Prepared by:

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Section for Environmental Public Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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PUBLIC HEALTH ASSESSMENT

NEWTON COUNTY WELLS (a/k/a SILVER CREEK TCE) JOPLIN, JASPER COUNTY, MISSOURI

SUMMARY

The Newton County TCE site contains an uncontrolled groundwater [plume](#) of trichloroethylene (TCE) contamination. The plume extends from the FAG Bearings property in Joplin, Missouri, in a southerly direction through the residential villages of Silver Creek and Saginaw, Missouri. There are very few businesses in the area. The source of contamination is believed to be FAG Bearings. From 1973 to 1982, FAG Bearings produced ball bearings using TCE as a commercial degreaser. It is alleged that improper disposal and leaks of an alleged closed system of TCE led to the contamination of soil at the industrial site, the groundwater aquifer, and subsequently, 82 private water wells. [Exposure](#) pathways at the site consist of [inhalation](#) of, [ingestion](#) of, and [dermal](#) contact with TCE- contaminated groundwater and surface water. Members of the community have expressed several health concerns which are addressed in the community health concerns section of this document.

There currently is a lack of sufficient information about the location of the TCE contamination plume. The most recent water well data for the site was collected in 1995. There is also a considerable amount of new home and well construction in the adjoining area. Although given the opportunity to connect to public drinking water system, there are approximately 65 households in the villages of Silver Creek and Saginaw that continue to use their private wells. Additionally, an unknown number of homes installed the pipes for public water, but continue to use their private wells. The data for air and soil suggest that there are no significant threats to public health for these [media](#) (1), therefore this health assessment will focus on groundwater issues.

Because completed and potential exposure pathways exist, the Newton County TCE site has been classified as a [Public Health Hazard](#). This category is used for sites that pose a public health [hazard](#) as a result of long-term exposures to hazardous substances (3). DOH recommends: that necessary actions be taken to prevent current and future exposures; that a sampling plan be developed and implemented to monitor the TCE contamination in the groundwater aquifer; that periodic water sampling continue in the future until the site can be remediated; and that a [health education](#) plan be developed and implemented to educate the public about potential health [risks](#) from exposure at this site.

PURPOSE AND HEALTH ISSUES

The Missouri Department of Health (DOH) has written this [public health assessment](#) to address past, current and future exposures for area residents to high levels of environmental (primarily groundwater) contamination at the Newton County TCE site.

BACKGROUND

Site Description and History

The Newton County TCE site is located near Joplin in northern Newton County, Missouri. The site begins

southeast of the intersection of Interstate 44, and State Highway 71, including the FAG Bearings property, and extends in a southerly direction encompassing the villages of Silver Creek and Saginaw (1) (a site map is located in [Appendix A](#)). The area of contamination is immediately south of I-44 and includes a portion of Joplin, and the villages of Silver Creek and Saginaw.

The contamination is currently thought to be coming from the FAG Bearings property(2), which lies directly north of Silver Creek and Saginaw, and is situated upgradient with respect to groundwater flow. The FAG Bearings Corporation has been in business in Joplin, Missouri, since 1970. From approximately 1973 through 1982, the company manufactured steel balls (used for ball bearings). A closed-loop system of trichloroethylene (TCE) was used for degreasing the balls. An estimated 40 tons of TCE were lost yearly. Supplier records indicate that 551, 55-gallon drums of TCE were delivered to the facility from 1972 to 1982. Disposal records indicate that two drums of TCE waste (still bottoms) were manifested as hazardous waste in 1983, leaving the disposal of the remaining 549 drums unaccounted for (1). Past and present employees have testified to several incidents of spills and other releases(2). Reportedly, the piping used to transport the TCE within the closed loop system would get clogged or components failed, creating spills.

A release of 10,000 gallons of cutting oil on FAG property was reported to the Missouri Department of Natural Resources (MDNR) on February 7, 1983. The company removed the contaminated soil and placed it in one of the abandoned [lagoons](#) on their property (1).

On April 23, 1991, DOH detected TCE and cis-1,2-dichloroethene (DCE) in two nearby private residential wells while conducting routine sampling for another site on the State of Missouri's Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Sites. Levels of TCE were found to be at 150 parts per billion (ppb) and 56 ppb, while levels of DCE were found to be at 12.3 ppb and 2.9 ppb, respectively. TCE and DCE were not chemicals associated with the existing site, so DOH initiated an investigation to determine the source and extent of TCE and DCE contamination. The residents using these two wells were notified of the results and instructed not to use their well water for potable purposes. DOH expanded private well sampling to Silver Creek in May 1991, and detected TCE contamination, up to 190 ppb, in additional wells. DOH again instructed affected residents to not use their water for potable purposes. DOH then notified the MDNR, who in turn notified the United States Environmental Protection Agency (EPA) (1).

EPA conducted a removal assessment of the site in May 1991. The two private wells previously found to have the highest levels of TCE were sampled again. TCE was detected at 190 ppb at the taps in both residences, which was well above the EPA Maximum Contaminant Level (MCL) of 5 ppb TCE (1). A MCL is the maximum permissible level of a [contaminant](#) in water that is delivered to the free-flowing outlet of the ultimate user of a public water system (3). DCE levels were detected below its MCL of 70 ppb, at 14 ppb and 13 ppb in these homes.

These results prompted the EPA to initiate a Time Critical Removal Action at the site. This action included supplying affected homes with bottled water until a permanent solution could be implemented. DOH issued a [public health advisory](#) on December 13, 1991, advising the residents of Silver Creek and Saginaw of the TCE groundwater contamination. Subsequent EPA and DOH private well testing, throughout Silver Creek and Saginaw, in December 1991 and January 1992, brought the total number of wells tested to 229. Of the wells sampled, 82 had detectable levels of TCE and 48 had TCE levels above 5 ppb, with the highest level of contamination being 280 ppb. By September 1993, another 120 wells had been tested, although none proved to have any detectable TCE contamination (1).

In May and June of 1995, private water well sampling was conducted for MDNR by a private contractor for a phase II remedial investigation. This comprehensive round of sampling surveyed 360 wells in Silver Creek and Saginaw, many of which had been previously sampled by other agencies. The sampling results varied from a high of 327 ppb of TCE to non-detects.

An April 2, 1992, [health consultation](#) for the Newton County TCE site, completed by the Agency for Toxic Substances and Disease Registry (ATSDR), concluded that prior to the EPA's actions, this site posed a

potential long-term threat to human health (4). ATSDR agreed with EPA's measure to provide bottled drinking water to affected homes. However, ATSDR also warned that residents whose homes had TCE levels higher than the MCL of 5 ppb were still being exposed to TCE via inhalation while showering, and washing clothes and dishes. ATSDR recommended that use of a whole-house alternative water supply be considered for residents whose wells significantly exceeded the MCL (4). In January 1992, construction was initiated for Silver Creek to access the Missouri American Water Company, the public water supply used by Joplin (1). This allowed residents the option of hooking up to the public drinking water system.

In July 1992, EPA prepared an Action Memorandum Amendment for the Newton County TCE site to provide bottled water to Saginaw residents (1). In October 1993, MDNR notified the Saginaw residents that they would provide funding for the installation of public water in Saginaw.

These funds were used to extend the public water system from Silver Creek to Saginaw. This task was accomplished in early 1994. (1)

The current known area of contamination includes 82 wells and two springs (one of which is used for drinking water), with detectable levels of TCE. TCE levels for the contaminated wells ranged from 1 ppb to 327 ppb. Forty-eight of the contaminated wells and both springs contained TCE levels above 5 ppb (1). The TCE-contaminated wells are located throughout Silver Creek and Saginaw, with the highest contamination levels found in wells along Morehead Drive in Silver Creek (see site map in [Appendix A](#)). It is unknown exactly how many homes are still using private wells.

Site Visit

On Monday, June 22, 1998, and Tuesday, June 23, 1998, state and local health department staff conducted a site visit at the Newton County TCE site. The purpose of this visit was: 1) to determine the extent of continued use of contaminated well water; 2) to determine the amount of new home and well construction in the area; 3) to determine the number and kinds of business establishments in the area; and 4) to become more familiar with the communities and the site.

There was a concern that large volumes of contaminated well water may still be used for purposes such as maintaining large vegetable or flower gardens or for filling swimming pools. During the visit, DOH personnel noticed that there were not many large gardens or swimming pools in the villages, and that this concern was probably unfounded. DOH made contact with the Missouri American Water Company to request copies of their customer records. The records were used to determine the number of residences in the villages on public water. After reviewing the records, DOH found that approximately 25 homes in Silver Creek and approximately 40 homes in Saginaw were not hooked up to the public water system. In a later conversation with a resident, it was discovered that, although his family connected the public water system pipes to the home, he never connected the public water lines to his home's plumbing. This family is still using their private well to supply water to their household. It is unknown how many other families may have done the same thing.

Another concern was that there may be a considerable amount of new home construction and, therefore, new well construction in the area. While driving in the area, DOH personnel noted new home construction throughout Silver Creek and to the south and east of Saginaw. This leads to the possibility that the new wells could be pumping water from the TCE-contaminated aquifer, therefore, a potential exposure pathway exists.

The number and kinds of business establishments in the area was unknown. It appears that there are only a handful of businesses in Silver Creek and Saginaw. Most of them are located along US Highway 71. They include gas stations and convenience stores, a few restaurants, a recreational vehicle dealer, and other small businesses. There appear to be no industrial businesses in Silver Creek and Saginaw.

Demographics

The Newton County TCE site encompasses the villages of Silver Creek and Saginaw and the FAG Bearings property in northern Newton County, Missouri (1). Approximately 513 people live in Silver Creek and 384 live in Saginaw. The population of the site is 99 percent white, with one-half percent Native American and one-half percent Asian. In 1990 there were 39 children under age six living in Silver Creek and 37 children under age six living in Saginaw. In 1990 there were 81 citizens over age 65 living in Silver Creek and 21 citizens over age 65 living in Saginaw. The median household income in Silver Creek is \$43,875, while the median household income in Saginaw is slightly lower at \$40,139. Seven of the 138 households in Silver Creek and five of the 125 households in Saginaw received public assistance in 1990 (5). In general, these communities represent white, middle-class suburbs.

Health Outcome Data

DOH searched their databases for Health Outcome Data (HOD) (birth, death, and disease records) for information about residents of Silver Creek and Saginaw. There was insufficient HOD to make any determinations about how this site may be affecting human health.

Land Use

The FAG Bearings facility is located within the city limits of Joplin, Missouri. This area of Joplin is zoned as industrial. Silver Creek and Saginaw are primarily residential communities. Very few businesses exist, and most people conduct their personal business in Joplin.

Natural Resources

The Newton County TCE site is situated within the Shoal Creek watershed and Grand River drainage basin. Silver Creek and Thurman Creek provide surface water drainage for most of the site. Shoal Creek is used as a water source for the city of Joplin. The Shoal Creek water is mixed with water from three deep wells to provide water to Joplin, Silver Creek and Saginaw. Silver Creek flows from east to west through Silver Creek village and Thurman Creek flows south into Shoal Creek (a site map is located in [Appendix A](#)) (1).

DISCUSSION

Pathways Analysis

To determine whether the residents of Silver Creek and Saginaw are exposed to contaminants migrating from the site, DOH evaluated the environmental and human components that lead to human exposure. This pathways analysis consists of five elements including a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure and an exposed population. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present. Completed pathways require that the five elements exist and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. Potential pathways, however, require that at least one of the five elements is missing, but could exist. Potential pathways indicate exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future.

Completed Exposure Pathways

Completed exposure pathways exist at the Newton County TCE site. The source of the contamination is believed to be past releases and improper disposal of trichloroethylene (TCE) at the FAG Bearings facility. The environmental media is contaminated groundwater. The point of exposure is at residences that have contaminated wells or at locations where contaminated surface water is found (springs). The routes of exposure include ingestion, inhalation, and skin contact. The exposed populations are people using contaminated well water and anyone who comes in contact with contaminated surface water. The time frame

for the completed exposure pathway is past, present and future. In the past, an exposure pathway was completed when residents used contaminated private wells as their sole source of water. Presently, although there is a public water supply in both villages, many of the private wells are still in use (1). The wells are mostly used for non-potable purposes such as washing vehicles and watering lawns and gardens. However, approximately 65 wells are still in use for drinking water purposes. Because the contaminated wells are still in use, a present completed exposure pathway exists. Although, the number of people currently exposed is not nearly as great as the past completed exposure pathway, until the source of contamination and the groundwater are remediated, or use of contaminated water well is discontinued, a future completed pathway exists.

Potential Exposure Pathways

Present and future potential exposure pathways exist. Because the TCE contamination remains in the groundwater at the Newton County TCE site, it is possible for people to be exposed in the present and future if new wells are drilled into the contaminated aquifer. Another potential future exposure pathway would be for the TCE contamination in the aquifer to continue to move and affect additional private wells. A third future potential exposure pathway exists in the possible contamination of surface water (springs). Since neither the source nor the environmental media have been removed or remedied, the potential exists for future exposure to contaminants from this site.

Toxicological Evaluation

Introduction

This section will discuss the health effects of exposure to specific contaminants. To evaluate health effects, ATSDR has developed a Minimal Risk Level (MRL) for contaminants commonly found at hazardous waste sites. The MRL is an estimate of daily human exposure to a contaminant below which non-cancer, adverse health effects are unlikely to occur. MRLs are developed for each route of exposure, such as ingestion and inhalation, and for the length of exposure, such as acute (less than 14 days), intermediate (15 to 364 days), and chronic (greater than 365 days) (3).

Trichloroethylene

TCE exposure through inhalation, ingestion, and skin contact has occurred, is occurring and may occur in the future for some residents of the site. TCE is known to have been used at the site since 1972. Since the public water system was not installed in Saginaw until 1994, past TCE exposure could have been ongoing for up to 21 years for some residents.

People can be exposed to TCE through inhalation while showering, bathing, and washing. Inhalation exposure to TCE was estimated for Silver Creek and Saginaw residents using TCE contaminated water. These calculations can be found in [Appendix B](#). Exposures were found to be below recommended levels for acute and intermediate exposures to TCE. ATSDR has not developed chronic recommendation levels for inhalation exposure to TCE. However, studies of chronic exposures to TCE have shown health effects on unborn and newborn animals including birth defects at levels similar to those at the Newton County TCE site (see the [children's health section](#)).

People can be exposed through ingestion by drinking contaminated water. Because of insufficient data, ATSDR does not have intermediate and chronic ingestion guidelines for TCE. Ingestion exposures were calculated, using the highest TCE concentration detected in a private well (0.327 ppm). These calculations can be found in [Appendix B](#). To calculate a dose, we assume that adults, on average, drink 2 liters (66 ounces) of tap water each day and weigh 70 Kg (154 pounds). For children, we assume that they drink 1 liter (33 ounces) of tap water each day and weigh 10 Kg (22 pounds) (3). The doses for adults and children at this site did not exceed any No Observed Adverse Effect Levels (NOAEL) seen in chronic animal studies, when these NOAELs were adjusted for human rather than animal studies. (6). A NOAEL is a chemical specific

dose at which no adverse health effects were observed in the study subjects (6).

People can be exposed through dermal (skin) contact by bathing in TCE contaminated water. Since ATSDR has no methodology to determine the amount of absorption of chemicals through the skin, ATSDR does not have recommended levels for skin exposure. For this reason, it is difficult to determine health effects from skin exposure. However, it is unlikely that exposure to TCE in the water, air, or soil at this site would be irritating to the skin (6).

Children and Other Sensitive Populations

A sensitive population will exhibit a different or enhanced response to hazardous chemicals than will most persons exposed to the same level of hazardous chemicals in the environment. Reasons may include genetic makeup, age, health and nutritional status, and exposures to other toxic substances. In general the elderly, with declining organ function, and the young, with immature and developing organs, will be more vulnerable to toxic substances than healthy adults (6).

Developing fetuses are susceptible to the toxic effects of chemicals that can cross the placental barrier. The period of fetal development is a time when chemical exposure may do the greatest harm. Laboratory and epidemiological studies suggest that fetal exposure to TCE may result in adverse health effects (6). In these studies, the amount of TCE given to the pregnant laboratory animals was approximately 100 times higher than that experienced by people residing above the groundwater contaminant plume(6). This indicates that the TCE exposure that occurred in Silver Creek and Saginaw may not have been at levels that could affect children (including fetuses). Other recent epidemiological studies indicate that some TCE exposures similar to those at Newton County TCE site could result in adverse health effects, such birth defects to children exposed as fetuses (6).

Since very high-level exposure (100 or more times as high as exposures at this site) to TCE is known to cause liver, kidney and heart damage, people with liver and kidney disease may also be more sensitive to the effects of TCE (6). In addition, people who consume alcohol or who are treated with disulfiram (a drug used to treat alcohol dependency) may be at greater risk of adverse health effects because both inhibit the body from eliminating TCE and can cause TCE to accumulate in the bloodstream (6).

Cancer

The EPA has developed cancer unit risk factors that can be used to determine the theoretical cancer risk for adults exposed to hazardous chemicals. Cancer risks are calculated over a lifetime, which is estimated at 70 years. The American Cancer Society estimates that in America, half of all men and one-third of all women will develop some form of cancer in their lifetime (7). DOH has calculated the cancer risk for the Newton County TCE site. These calculations can be found in [Appendix B](#). Overall, there might be a slight elevated risk of developing cancer from lifetime exposure to contaminated groundwater at the Newton County TCE site.

COMMUNITY HEALTH CONCERNS

A public availability session was held January 12, 1999 to gather health concerns from the community. Several individuals expressed specific concerns that will be addressed in this section. This section only addresses concerns raised by community members at that meeting, and is not meant to be an inclusive listing of possible health effects.

A. Heart Problems

1. Can exposure to TCE in drinking water at Newton County TCE site cause heart problems?

It is not clear from the literature whether there is a relationship between heart disease and TCE exposure. Cardiovascular effects were investigated in families participating in a childhood leukemia study in Woburn, Massachusetts. Families chosen for the study included those with at least one child with leukemia (6). Levels of TCE contamination in drinking water in this study were similar to those at the Newton County TCE site, although the water in Woburn, Massachusetts, also contained contaminants other than TCE. In the study, medical and laboratory tests were conducted on 25 family members (6). There were 14 surviving parents, all of whom complained of symptoms including unexplained rapid heart rate at rest, palpitations, or near syncope (a brief lapse in consciousness caused by a lack of oxygen to the brain). Eleven of the adults were given resting and exercise electrocardiograms, and echocardiograms. Of these 11, eight had serious ventricular dysfunctions, seven had multi-focal premature ventricular beats and six required cardiac medication (6). None of the subjects had clinically significant coronary artery disease (6). No background information on family history of heart disease, smoking habits, or occupational history was given on any of the 25 family members in the study (6) making it difficult to make inferences from the study to this site. Excess cases of anemia, stroke, blood disorders, and death from heart disease were reported in the ATSDR subregistry of persons environmentally exposed to TCE (6). However, the data were gathered by a self-reported questionnaire, may be limited by reporting bias, and could be attributed to many other causes than TCE exposure.

B. Gastrointestinal Problems

1. Can gastrointestinal problems be caused by drinking TCE-contaminated water?

It is not likely that exposure to TCE contaminated drinking water would cause gastrointestinal problems at this site. Some people exposed to TCE and other contaminants in drinking water in Woburn, Massachusetts, complained of chronic nausea, episodic diarrhea, and constipation (6). Although 52% of the study subjects had these complaints, these general signs could not be specifically attributed to the TCE (6). Self-reported gastrointestinal problems were not increased among persons in the TCE subregistry who were exposed to TCE in their drinking water (6). Cellular changes in the gastrointestinal tract have not been observed in intermediate or chronic-duration studies in which rats and mice were fed TCE in corn oil or olive oil with a stomach tube (6). The maximum doses used in these studies were up to 10,000 times the exposures that would be expected at the Newton County TCE site.

C. Liver and Kidney Questions

1. Can drinking TCE-contaminated water adversely effect my liver?

It is not likely that exposure to TCE contaminated drinking water would cause liver problems at this site. Although no studies involving humans and TCE's effect on the liver were located, several studies involving laboratory animals indicate that the nervous system and liver, and to a lesser degree the heart and kidney are the primary organs of adults impacted by TCE (6). However, the amount of TCE needed to produce adverse health impacts in laboratory animals have been documented to occur at levels much higher (more than 100 times higher) than those that occurred to the people residing above the contaminated groundwater plume and who drank contaminated drinking water. People with pre-existing liver conditions, who consume alcohol or are treated with disulfiram (a drug used to treat alcohol dependency) may be at greater risk for adverse health effects to their liver from TCE exposures at this site.

2. Can drinking TCE-contaminated water adversely effect my kidneys?

It is not clear from the literature whether there is a relationship between kidney problems and TCE exposure. Several human and animal studies involving TCE-contaminated drinking water and kidney function have been conducted. One study suggests an association between long-term exposure to solvent-contaminated well water and increased urinary tract infections in children(6). However, there was no indication that clinical chemistry testing of urine samples had been done; such testing might have detected changes in kidney

function (6). It is also important to note that the children involved in the study were exposed to a number of solvents, only one of which was TCE (6). In another study involving well-water contamination, three communities in Michigan that were exposed to TCE and other solvents in drinking water had no increase in kidney disease (6). Self reported urinary tract disorders were increased in females under 10 years of age, males and females age 18 through 34 years of age, females 35 through 44 years of age and females 55 years of age and older among TCE subregistry participants who were exposed to TCE in drinking water.

D. Reproductive Problems

1. Can drinking TCE-contaminated water cause fertility problems?

It is unlikely that adverse reproductive effects would occur at this site due to TCE exposure. Adverse reproductive effects were not noted in a human population in Massachusetts that was exposed to TCE in drinking water (6). In three communities in Michigan exposed to TCE and other solvents in drinking water, there was no increase in adverse pregnancy outcomes. A few studies of women occupationally exposed to TCE suggest that women may have an increased risk of adverse reproductive effects, primarily menstrual disorders and spontaneous abortions (miscarriages)(usually occurring within the first 12 weeks of pregnancy) (6). Interpretation of these studies is complicated by limiting factors, such as limited data and inadequate data collection methods. Other studies have not found an association between TCE exposures and spontaneous abortions (6). Most of the women in these studies were exposed to TCE at much higher levels than what occurred at the Newton County TCE site. Therefore, it is unlikely that the elevated occurrence reported by these studies would occur at the Newton County TCE site.

2. Can any health impact from drinking TCE-contaminated water in the past be inherited by future generations?

It is unlikely that a child's or grandchild's health would be affected as the result of genetic damage to the parents or grandparents due to TCE exposures from private drinking water wells. For these types of effects to occur, the exposure to the parent or grandparent must result in an effect that can be passed on to (inherited by) the offspring. In other words, the TCE exposure would have to cause a change in the parents' or grandparents' DNA. No studies (human or animal) have directly linked TCE with inherited disorders or with changes to a person's DNA.

E. Neurological Problems

1. Can exposure to TCE-contaminated drinking water cause neurological problems?

It is not likely that neurological problems would occur due to TCE exposures at this site. The epidemiological studies of the people exposed to TCE, as well as other chemicals, from well water in Woburn, Massachusetts, did not reveal neurological complaints. Some of the people from this population did show residual damage to the facial nerves, measured by a decreased blink reflex 6 years post-exposure (6). However, this study is limited by the lack of individual exposure data. A study of residents exposed to well water containing TCE (6 to 500 ppb) and other chemicals in Tucson, Arizona showed significant decreases in blink reflex, eye closure, choice reaction time and intelligence test scores as well as increases in mood disorders (6). Further study of this population revealed impaired balance (6). It should be noted that individual exposure information was lacking in this study also. Among persons in the TCE exposure subregistry, a statistically significant increase in impairment of hearing was reported in children age 9 years and younger (6).

2. Can exposure to TCE-contaminated drinking water cause Parkinson's Disease?

Although no specific studies have been conducted relating TCE and Parkinson's Disease, there is no data that suggests that exposure to TCE-contaminated drinking water can cause Parkinson's Disease. The cause of Parkinson's Disease remains unknown (8). Most people who develop symptoms of primary Parkinson's disease have "Idiopathic Parkinson's Disease" (idiopathic meaning the exact cause is unknown) (8). Patients

may attempt to link the onset of Parkinson symptoms with some acute trauma... an accident, surgery, or extreme emotional distress (8). Most neurologists discount any direct link; a traumatic event might trigger symptoms before they would otherwise manifest, but this should not be confused with actual causation of the Parkinsonism (8). There are also secondary forms of Parkinsonism. Some drugs interfere with the brain's metabolism of dopamine, and prolonged use of these drugs can produce Parkinson features. These medications include: haloperidol and other medications used to treat hallucinations and confusion in the elderly; some anti-hypertensive drugs which contain reserpine; and a commonly prescribed anti-nausea drug metoclopramide (Reglan) (8).

F. Other Health Questions

1. Would watering a garden with TCE-contaminated groundwater pose a health risk to people who eat the vegetables from the garden?

Eating vegetables watered with local groundwater does not pose a significant health risk TCE found in groundwater is not known to bioconcentrate (build up) in plants to any significant degree (6). Laboratory studies have been conducted to see if vegetables store TCE and have determined that minimal accumulation of TCE occurs in vegetables. Although, as with any fruits or vegetables, it is important to properly wash (in uncontaminated water) or peel the fruits and vegetables from your garden.

2. Does the human body retain or store any of the TCE found in private drinking water wells?

Because TCE evaporates very rapidly and the human body quickly removes TCE, it is not retained or stored in the human body for any significant amount of time (6). Once exposure has stopped, your body will remove TCE from your system in about one week (6).

3. Is it safe to allow children to run through the sprinkler with TCE-contaminated well water?

No health effects are expected from this type of exposure. TCE volatilizes from running water very quickly. Because this would be an outdoor activity, the concentration of TCE mixed into the outdoor air would be relatively low. There have been no studies related to TCE-contaminated groundwater and children running through the sprinkler. However, because small children would be in the mist of the water and vapor, it is possible that children could potentially be exposed to TCE. As a precaution, because we do not know what types of exposures may result from this activity, parents may want to limit the amount of time they allow children to run through the sprinkler with TCE-contaminated well water.

PUBLIC HEALTH ASSESSMENT

NEWTON COUNTY WELLS (a/k/a SILVER CREEK TCE)
JOPLIN, JASPER COUNTY, MISSOURI

CONCLUSIONS

The Newton County TCE site has been classified as a **Public Health Hazard**. This classification is based on the following conclusions:

1. Groundwater and surface water at the site are contaminated with TCE at levels of health concern.
2. There are completed exposure pathways for chronic exposure to TCE at this site which could lead to adverse health effects.
3. There are approximately 65 homes in the villages of Silver Creek and Saginaw that are not on public water. Some of the wells are known to have had TCE contamination in 1995; it is unknown how many of these wells are presently contaminated with TCE.
4. The latest water well information available was collected in the summer of 1995. It is possible that the TCE plume has moved since that time, and possibly contaminated more private wells. TCE levels may also have changed since 1995.
5. There is considerable new construction in the area; therefore, it is possible that new water wells are being drilled into the contaminated aquifer.

RECOMMENDATIONS

1. Take necessary actions to remove the current and potential exposure pathways from groundwater and other environmental media.
2. Develop and implement a sampling plan to sample the current condition of private water wells.
3. Continue periodic water sampling in the future to assure residents are not unknowingly drinking contaminated water.
4. Develop and implement a health education plan to educate the community about the exposure pathways at this site.

When additional information becomes available, it will be thoroughly evaluated, and existing assessment documents will be updated to reflect any changes. DOH/ATSDR will respond appropriately to any request

for additional information or action.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for the Newton County TCE site contains a description of actions to be taken by the Missouri Department of Health (DOH), the Agency for Toxic Substances and Disease Registry (ATSDR) and others. The purpose of the PHAP is to ensure that this public health assessment not only identifies public health hazards, but provides an action plan to mitigate and prevent adverse human health effects resulting from past, present, and/or future exposures to hazardous substances at or near the site. Included is a commitment from DOH and/or ATSDR to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by DOH, ATSDR and/or cooperators are as follows:

1. The Missouri Department of Natural Resources began conducting private well sampling at the site in early March, 1999. Sampling results are not yet available, but will be reviewed by DOH/ATSDR when made available. Appropriate public health recommendations will be made at that time, if necessary.
2. DOH/ATSDR will coordinate with the appropriate environmental agencies to implement the recommendations in this public health assessment.
3. DOH/ATSDR will develop and implement a health education plan for the Newton County TCE site.
4. DOH/ATSDR will provide follow-up to this PHAP as necessary. This follow-up report will be placed in the repositories that contain this public health assessment.
5. DOH/ATSDR will evaluate any further data that become available about human exposure or contaminants at the site.

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CERTIFICATION

This Newton County TCE Site Public Health Assessment was prepared by the Missouri Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

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The Division of Health Assessment and Consultation (DHAC), ATSDR has reviewed this public health assessment and concurs with its findings.

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PUBLIC HEALTH ASSESSMENT

NEWTON COUNTY WELLS (a/k/a SILVER CREEK TCE)
JOPLIN, JASPER COUNTY, MISSOURI

APPENDIX A



[Figure 1. Site Map](#)

APPENDIX B

Exposure Calculations

Ingestion Exposure Calculations

$$IDw = \frac{C \times IR \times EF}{BW}$$

where:

IDw = ingestion exposure dose (mg/Kg/day)

C = contaminant concentration (mg/L)

IR = ingestion rate

EF = exposure factor

BW = body weight

Adult:

$$IDw = \frac{.327 \text{ mg/L} \times 2 \text{ L/day} \times 1}{70 \text{ Kg}}$$

$$70 \text{ Kg}$$

$$IDw = 0.0093 \text{ mg/Kg/day}$$

This calculation assumes that an adult weighs 70 Kg and drinks 2 L of tap water per day.

Child:

$$IDw = \frac{.327 \text{ mg/L} \times 1 \text{ L} \times 1}{10 \text{ Kg}}$$

$$10 \text{ Kg}$$

$$IDw = .0327 \text{ mg/Kg/day}$$

This calculation assumes a child weighs 10 Kg and drinks 1 L of tap water per day.

Inhalation exposure for TCE in drinking water

In order to estimate the inhalation exposure residents of Saginaw and Silver Creek experienced, we need to make some assumptions. These are: a person breathes in approximately 15 cubic meters of air per day; that they live in a 2000 square foot, three bedroom home; that there is 100% TCE volatilization from water; and that water usage in a home is approximately 120 gallons/bedroom.

$$\text{Inhalation Exposure} = \frac{\text{concentration of TCE in water} \times \text{volume of water used}}{\text{volume of air in home}}$$

$$\text{concentration of TCE in water} = .327 \text{ mg/L or } .327 \text{ mg/Kg}$$

$$\begin{aligned}\text{volume of water} &= 3 \text{ bedrooms} \times 120 \text{ gallons/bedroom} = 360 \text{ gallons} \\ 360 \text{ gallons} \times 3.785 \text{ L/gallon} &= 1363 \text{ Liters} \times 1 \text{ Kg/L} = 1363 \text{ Kg}\end{aligned}$$

$$\begin{aligned}\text{volume of air in home} &= 2000 \text{ square feet} \times 8 \text{ feet height} = 16,000 \text{ cubic feet} \\ 16,000 \text{ cubic feet} / 35.314 &= 453 \text{ cubic meters}\end{aligned}$$

$$\text{Inhalation Exposure} = \frac{.327 \text{ mg/Kg TCE} \times 1363 \text{ Kg water}}{453 \text{ cubic meters}}$$

$$\text{Inhalation Exposure} = .984 \text{ mg/cubic meter}$$

The MRL for acute exposure to TCE in air is 2 parts per million. (7)
1 part per million is equal to 5.4 mg/cubic meter
Therefore, the MRL is equal to 10.8 mg/cubic meter

The inhalation exposure for Silver Creek and Saginaw residents is approximately ten times lower than the acute Minimal Risk Level.

Cancer Calculations

Formula:

$$\frac{\text{Exposure dose} \times \text{risk factor} \times \text{years of exposure}}{70 \text{ years (lifetime)}} = \text{risk of cancer}$$

Inhalation Exposure:

$$\frac{984 \text{ ug/cubic meter TCE} \times .0000017 \times 70 \text{ years}}{70 \text{ years}} = 0.00167$$

Ingestion Exposure:

$$\frac{.0093 \text{ ug/L TCE} \times .011 \times 70 \text{ years}}{70 \text{ years}} = .0001023$$

SITE MAP
Newton County TCE Site

